

General Comments:

In general we do not remember these sampling plans being discussed in a ground water work group meeting other than general mention of the actinide drilling artifact investigation. Appropriate use of the collaborative process should include better discussion of these projects with the State and EPA before submission of a SAP.

**Response:** *Agreed. The Site will strive to more completely alert the State and EPA of upcoming groundwater projects at the working group meetings.*

Specific Comments:

1) Section 1.3.3.1 - The discussion here is rather general. In our evaluation the utility trenches appear to have been installed about 7 feet below the top of bedrock in the center of the IA, through the 700 Buildings and north of the 800 Buildings. This probably provides a preferential pathway for contaminated groundwater to flow, from the "plume" to the west, into and through this area. Since the area around the 700 Buildings appears to generally be dry or have less than five (5) feet, and often less than a foot, of groundwater saturation, movement through the utility trenches may provide an improved pathway for this groundwater migration into and through this area to the east. Monitoring needs to be properly placed to provide an adequate determination of the possible effects of the utility trenches in this area. It is uncertain if the proposed monitoring well locations will provide adequate monitoring of the groundwater and contamination that may be moving through these trenches below bedrock. Please include the locations of the utility trenches on figure 3-2. This map should also show the depths of the trenches.

**Response:** *The discussion presented in Section 1.3.3.1 is necessarily general because the effect of utility lines on groundwater flow and contaminant transport has not previously been evaluated in detail, nor is it possible to do so within the scope of this SAP. The proposed well program was designed to evaluate the eastern extent of the IA VOC Plume, which is made more difficult by potential contaminant migration along the east-west oriented utility corridors. We agree that these lines could have a significant impact on groundwater flow in the IA; however, it is not possible to monitor contaminant migration along these lines because of the difficulty and hazards involved in installing wells in the trenches, unless monitoring wells are placed at the downgradient terminus of the trench. This approach does not appear to be feasible given the length and layout of the trenches. The location of utilities has been added to Figure 3-2. It is not possible to show trench depths on the map because this type of information is generally unavailable from site utility drawings, and only sparingly available from ER IA reports.*

2) Section 2.5.2 - This decision rule may not be complete. The findings of this SAP may not completely support the proposed decision. It is unclear that not finding contamination will trigger a later investigation of transport within the utility corridors.

**Response:** *This decision rule does not preclude further investigations of utility corridors. The presence or absence of contamination in the wells will help redraw the plume east boundary, with the understanding that the actual role of east-west corridors in spreading contamination eastward will remain an unknown. The investigation should shed considerable light on the influence of the Eighth Street corridor on eastward plume movement, which, if shown to be significant, will tend to implicate, rather than exonerate, the east-west corridors as likely pathways for plume movement.*

3) Section 2.5.3 - Does "assess probable collection system effectiveness with respect to plume" include expansion of the collection system if it is not deemed effective in capturing this suspected portion of the plume?

**Response:** *No. The collection system has already been extended westward starting at the easternmost bend in the trench to account for this possibility. No further expansion is envisioned at this time. The wells will serve as performance monitoring wells.*

4) Section 2.6.2 - Since the wells may not be placed directly in the utility trenches, not identifying contamination or groundwater may not mean that contamination, or groundwater, does not exist near the well location in the trench.

**Response:** *Agreed. In other words, the absence of proof is not the proof of absence. The monitoring program will be able to accomplish its principal goal of determining whether the IA VOC plume is widespread beyond the Eighth Street utility corridor.*

5) Section 2.7.2 - We have previously indicated concern that small diameter wells are capable of providing adequate sample volumes in areas of thin saturated thickness. While only VOC analysis is proposed in this SAP what other uses may be made of these wells? Considering the hydrogeologic conditions that exist in this area should larger diameter wells be installed?

**Response:** *In many cases, it is expected that these wells may benefit other projects, including D&D and IA IHSS characterization, and such wells are actually preferable for monitoring water levels in low-permeability formations. The utility and limitations of small diameter vs. large diameter wells for obtaining samples was addressed in CDPHE comment responses for the D&D Groundwater monitoring SAP (not available at the time this comment was made). Small borehole storage volumes associated with these wells will make sampling larger volumes more of a challenge (i.e., more well visits), but the samples collected should, both in theory and practice, be more representative of groundwater conditions because of shorter stagnation periods between sampling visits.*

6) Section 3.3.1 - a) The rationale for the location of proposed well 61399 is not clearly understood. Since there are already two wells (wells 02397 & 22795) located immediately adjacent to this proposed location (which appear to have contamination), please indicate the rationale for placing another well at this location. Possibly moving this location to the west along the utility corridor between buildings 777 and 778, or to the east immediately south of Building 779 north of wells 2486 & 2386 (which do not appear to have contamination). Possibly adding another well to cover both of these locations might be a better way to try to show the extent of this plume.

**Response:** *We agree that the location of 61399 is too close to 02397 and 22795 to improve our knowledge of the IA VOC plume in this area. Considering the problems involved in properly monitoring utility corridor groundwater, this well has been eliminated from the proposed program. We believe that relocation of the well to the suggested places offers no advantage over the existing locations because the well would still monitor groundwater outside of the utility trenches. It is proposed that this well be moved south of B707 in response to Comment #6b.*

b) It appears that another well needs to be located about midway between well P213689 and the proposed well 60799. This additional well appears to be necessary to properly monitor the possible natural pathway or channel that seems to be evident on Figure 1-5. Figure 1-5 appears to show an elongated east-west channel that has a greater than ten (10) foot depth to bedrock as well as a greater than ten (10) foot depth to the top of groundwater. Well P213689 appears to be located outside of this possible channel, and the proposed well 60799 appears to also be outside, or on the edge, of this possible channel. As such, a well needs to be placed in this apparent channel to properly identify and monitor any contaminant migration that may be occurring through this possible channel.

**Response:** *It is not possible to locate a well between wells P213689 and 60799 because of the Protected Area perimeter fence. To monitor contaminant conditions in the channel, a well has been added south of B707 and approximately 200 feet east of well 60799.*

#### *Actinide Drilling-Artifact Contamination*

On page 19, sampling the subsurface soils in the new wells is discussed. Were any similar samples collected from the wells that are being twinned (1587, 06991, 11791, and P313489) or are there archived cores or cuttings from these wells that could be analyzed for actinide contamination? If so, these subsurface samples could provide some valuable information and should be made a part of this investigation.

**Response:** Continuous cores from wells 1587, 06991, 11791, and P313489 are archived by the Site, but unfortunately, are not of much value to the proposed investigation. When collected, alluvial core is typically highly disturbed and loose to poorly consolidated, which can lead to mixing of core materials during sampling, logging, transport, and subsequent reexaminations. Potential cross-contamination during drilling, which presumably affects the groundwater samples, is also a concern for soil core samples. As the cores were not specifically collected and stored for actinide sampling, their use in defining the vertical distribution of actinide contamination is suspect.

Table 3-1 shows that well 50399 will be drilled ten feet south of well P313489 and the rationale indicates that this would be a cross-gradient location. The other three wells being drilled for this investigation are all being placed in upgradient locations and this well should likewise be located upgradient, or west of P313489.

**Response:** Well 50399 is located south (cross-gradient) of well P313489 for two reasons which should have been explained in the SAP. An upgradient (west) location to well P313489 would place well 50399 at the edge of the Seventh Street roadway, obstruct traffic during drilling and sampling, and expose the well to potential vehicular damage. More importantly, well P313489 is located in a shallow ditch that could contain actinide-contaminated soils/sediments. This setting may contribute to drilling-artifact contamination. Placement of well 50399 in the ditch will best replicate the soil and drilling conditions of well P313489.

Section 3.2.3, Well Development, on page 32, states that repeated vigorous surging using a bailer will be performed to remove borehole disturbed materials to the extent possible, with the main objective being to improve well yields and reduce turbidity levels. These are worthwhile objectives, but vigorous surging with a bailer might also have the adverse effect of increasing the zone of influence of the new well and pulling in contaminants from the original well. Although there does seem to be some correlation between total suspended solids and actinide activity levels, the working hypothesis for this investigation is that special drilling methods will prevent dragging surficial level actinides deeper into the borehole. If these drilling methods are successful, the suspended solids around the new borehole should not be contaminated with actinides, and so, reduction of suspended solids would not be of primary concern. For these reasons, it is suggested that alternate methods of well development be considered.

**Response:** It is not anticipated that vigorous surging will greatly increase the zone of influence and bring in contaminants from the original well for several reasons:

- 1) Overdevelopment of aquifers is possible, but is less likely in low to moderately permeable formations, where well yields are typically too low to develop the well effectively. Furthermore, in monitoring wells such as these, the well screen and filter pack will dampen out most of the surging action applied in the well casing resulting in very little surging energy reaching the borehole wall.
- 2) Groundwater removed from the well during development and sampling operations will amount to a relatively small fraction of the total volume of available water occurring within a 10 foot radius of the well. Even if enough groundwater is pumped from a well to cause transport of contaminants from a nearby source, the fraction of well inflow coming from the source is expected to be negligible. Assuming radial flow conditions, the fraction of flow contributed by a well with a 10 inch (0.83 foot) diameter borehole (source width) is

*estimated to be only about 1 percent based on a perimeter length of 62.8 feet (10 foot radius).*

*3) It is expected that concentration levels of actinide drilling-artifact contamination transported through an aquifer from a contaminated well will be considerably lower than the historical concentrations measured in groundwater collected from the well, owing to markedly different hydraulic and transport conditions for the two scenerios.*

*The drilling and well installation techniques used for these wells will greatly reduce, but not necessarily entirely eliminate, the potential for contamination from surface soils. For this reason, it is essential that every possible precaution be taken to ensure that samples collected from the wells are representative of aquifer conditions. Well development is an important process for removing potential contamination introduced during drilling and well installation. Removal of excess borehole smear materials, as indicated by reduction of turbidity levels and improvement in well yields, is a standard objective of well development programs, but is all the more critical for this type of investigation.*

Section 3.2.5, Sample Collection, page 33, proposes sampling from the new well in a pair first because it obeys the principle of sampling from least contamination to worse contaminated. This might make sense from an equipment contamination standpoint, but on the other hand, it would also increase the likelihood of pulling contaminants from the area of the old well into the zone of influence of the new well. It might make more sense to use two different bailers for sampling, and sample the original well first to decrease the possibility of cross contamination.

**Response:** *The SAP will be rewritten to adopt the use of two different bailers for sampling the actinide well pairs: one for sampling new wells and one for sampling existing wells. The wells will be sampled from areas of least contamination to worse contamination. It shouldn't matter which well in a pair is sampled first (see response to comment #3 above), but to further reduce the possibility of cross contamination, the original well of each pair will be sampled first.*